

What is claimed is:

1. A resonator apparatus, of the type used in filters for an electrical signal, comprising:
 - 5 a. a first resonator device, having a first end and a second end;
 - b. a second resonator device; and
 - c. wherein the first end and the second end are arranged and configured to lie on the same side of the first resonator and proximate the second resonator, and wherein the distance of the first end from the second resonator creates a primary
 - 10 coupling between the first and second resonators, and the distance and length of the second end creates a secondary coupling between the first and second resonators, whereby the overall distance of the first and second resonators from one another may be optimized by controlling either the primary or secondary coupling.
- 15 2. The resonator apparatus of claim 1, wherein the first and second resonator devices are constructed in an HTS microstrip configuration.
3. The resonator apparatus of claim 1, wherein the first end is arranged and configured to provide a substantially larger interface to the second resonator than the
- 20 second end.
4. The resonator apparatus of claim 1, further comprising a coupling strip which couples the second end to the second resonator.
- 25 5. The resonator apparatus of claim 4, wherein the primary coupling $F1$ is a function of the distance $S1$ between the first and second resonators, and the secondary coupling $F2$ is a function of $S2a$, $S2b$, $L2a$ and $L2b$ where $S2a$ is the distance between the coupling strip and the first resonator and $L2a$ is the length of the coupling strip which lies adjacent the first resonator, $S2b$ is the distance between
- 30 the coupling strip and the second resonator and $L2b$ is the length of the coupling strip which lies adjacent the second resonator, wherein the total coupling between the first resonator and the second resonator, F , is defined by:

$$F = F1(S1) + F2(S2a, S2b, L2a, L2b).$$
- 35 6. The resonator apparatus of claim 1, wherein the primary coupling can be either capacitive or inductive and the secondary coupling can be either capacitive or inductive.

7. The resonator apparatus of claim 1, wherein the primary coupling can be either capacitive or inductive.

8. The resonator apparatus of claim 1, wherein the secondary coupling can be
5 either capacitive or inductive.

9. The resonator apparatus of claim 1, further comprising at least one non-adjacent resonator device and a coupling strip between the first resonator and the at least one non-adjacent resonator device.

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10. The resonator apparatus of claim 2, wherein the micro-strip topology includes a dielectric substrate of either MgO, LaAlO₃, Al₂O₃, or YSZ

11. A filter for electrical signals, comprising:

- 15 a. a plurality of resonators, at least one resonator having a first end and a second end; and
- b. the first end and the second end being arranged and configured to lie on the same side of the at least one first resonator and proximate a second resonator, and wherein the distance of the first end from the second resonator creates a primary
20 coupling between the at least first and second resonators, and the distance and length of the second end creates a secondary coupling between the at least first and second resonators, whereby the overall distance of the at least first and second resonators from one another may be optimized by controlling either the primary or secondary coupling.

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12. A filter for electrical signals, comprising:

- a. a first resonator device;
- b. a second resonator device;
- c. a coupling strip between the first and second resonators; and
- 30 d. the first resonator device and the second resonator device having a primary coupling and a secondary coupling between the first and second resonators, wherein the overall distance of the first and second resonators from one another establishes the primary coupling and the distance between the coupling strip and the overlap with the first and second resonators establishes the secondary coupling,
35 whereby the distances between adjacent resonators may be optimized by controlling either the primary or secondary coupling.

13. A method of controlling coupling in an electric signal filter, having a first and second resonator and a coupling strip, comprising the steps of:

a. determining the primary coupling between the first and second resonators based on the desired distance between the first and second resonators;

5 b. determining the desired secondary coupling in order to arrive at the total desired coupling between the first and second resonators; and

c. determining the distances and lengths of the coupling strip from the first and second resonators to achieve the determined secondary coupling $F2$, where $F2$ is a function of $S2a$, $S2b$, $L2a$ and $L2b$, and $S2a$ is defined as the distance
 10 between the coupling strip and the first resonator, $L2a$ is the length of the coupling strip which lies adjacent the first resonator, $S2b$ is the distance between the coupling strip and the second resonator, and $L2b$ is the length of the coupling strip which lies adjacent the second resonator, the primary coupling $F1$, wherein the total coupling between the first resonator and the second resonator, F , is defined by:

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$$F = F1(S1) + F2(S2a, S2b, L2a, L2b).$$

14. The method of claim 13, further comprising the step of locating at least one non-adjacent resonator device and a coupling strip between the first resonator and
 20 the at least one non-adjacent resonator device.